WASHINGTON
SCIENCE TRENDS

HIGHLIGHTS

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Air Force Research Division Established

Basic research will be the responsibility of the new Air Force Research Division to be headed by Brig. Gen. B.G. Holzman, who has been commander of the Air Force Office of Scientific Research (AFOSR). Col. A.P. Gagge, who has been vice commander of AFOSR will now command that organization. Both will be headquartered in Washington.

Air Force Research Division (AFRD) will have prime Air Force responsibility in fields of basic research and will sponsor research programs with educational institutions and non-profit and industrial research organizations. In addition to AFOSR the new Division will include The Aeronautical Research Laboratory, Wright Patterson AFB, Dayton, Ohio and the European Office of the Air Research and Development Command, Brussels, Belgium.

Formation of the Research Division places it at the same organizational level of the Air Research and Development command as engineering and systems development. The Air Force says this new status underscores the importance placed upon basic studies. Funds allocated for basic research by the Air Force have more than doubled in the past five years and further increases are planned for the future.

AFOSR will continue to operate under the same policies and procedures which have characterized its relationship with universities, non-profit research institutions and industrial contractors. In addition, the Research Division will have its own scientists who will be encouraged to prosecute basic research in their special fields.

NEW NBS Research Projects

Two new research projects will be sponsored by the National Bureau of Standards in the coming year. A highly-classified program calls for development of detection equipment to safeguard information in safes and security installations. And the Bureau plans to spend $250,000, chiefly under contract, for a fundamental study of fire using computer methods and recently developed methods of scientific approach.

Federal Research Budget: A few copies are still available of our popular digest and analysis of the Federal Government's research and development and military procurement budget for Fiscal 1961. Contact Washington SCIENCE TRENDS, 1120 National Press Building, Washington 4, D. C. Copies $1 each.

Special Property Materials

Reports received by Congress on high-temperature and other special property materials indicate trends in requirements for military and space projects.

Defense Department believes that there is "A fair prospect" that significantly larger amounts of beryllium, molybdenum, bismuth, tellurium, helium and titanium will be required during the next four or five years.

Materials which are not now of any major consequence in engineering applications but which are receiving research attention because of potentially attractive properties include rhenium, hafnium, yttrium, cesium, rubidium, eropium, gadolinium and scandium.

Materials now in demand which may encounter substantial additional demand in the future because of military programs include platinum group metals (rhodium), columbium, vanadium, tungsten, tantalum, selenium, zirconium, thorium, lithium, magnesium, silicon, cadmium, silver, quartz crystal and gallium.

Materials receiving increased R&D attention in the field of thermoelectric or solid-state-conversion effects include tellurium, aluminum, antimony, arsenic, gallium, germanium, indium, lead, nickel, selenium, silver and sulfur.

* Refractory Materials

The Materials Advisory Board of the National Academy of Sciences, in a confidential report to the Defense Department and Congress, reviewed problems and progress in the use of refractory materials for air and space craft. Among the conclusions:

* Metals of importance of structural use in air vehicles are molybdenum, columbium, tungsten and tantalum. Of these, molybdenum and columbium will be used generally below 3,000 degrees fahrenheit, largely in applications between 1,800 degrees and 2,600 degrees. It is believed that tungsten and tantalum will be employed most frequently in those situations where operating temperatures exceed 2,600 degrees.

* Application problems are said to include protective coating, producibility, welding and analytical chemistry. It is suggested that producibility problems can be attacked directly with high probability of ~~early~~ success if adequate funding is available and sound programs are organized. Welding is said to be a more serious problem. Small laboratory welds, subjected to post-weld mechanical and thermal treatments have exhibited ductility but larger welds under production conditions generally have not. Oxidation resistance is said to be a very difficult problem, with no approach yet offering a universal solution although protection is possible for limited times under specific conditions. Work on coatings is said to be of critical importance, particularly on application to larger assemblies. It is suggested that probability of limited success in this field is quite high, but that universal success is not considered likely at this time.

* Basic Research for refractory metals is said to be mandatory in a number of areas since it is held unlikely that major improvements in alloys will be possible without increased support. This is said to include phase diagram studies, transition temperature for ductile to brittle fracture, oxidation and surface protection, methods of purification of the pure metal and purification of alloys during melting, thermal shock resistance, physical metallurgy and fabrication and deformation characteristics.

  The MAB committee advised that present efforts in these fields are neither broad enough nor intense enough to provide the desired information necessary for alloy development and application.

* Materials for Propellant Systems are another critical area, according to MAB.

  The Board explains: "In chemical rocket propulsion systems, liquid propellants for rockets are generally circulated as coolants in the area of the high temperature exhaust at the nozzle of the rocket motor. Accordingly, the very high temperatures in the flame can be tolerated by rather low temperature materials. However, solid rocket motors cannot be cooled by any known techniques that are reliable. Accordingly, the material of the rocket nozzle must be selected and developed so as to withstand very high temperature gases moving at high velocities.

  "Improvement in the effectiveness of propellants is desirable to increase the range and performance of the solid rocket motor itself. However, the improvements that may yield a 10-percent increase in impulse are always accompanied by an increase in flame temperature.

  "Flame temperatures are now being considered that approach the melting points of the most refractory of the metals. Unless these high-temperature metals are available and provided with suitable nonmetallic coatings or backup structure, the high-performance fuels are of little direct utility.

  "Refractory metals based on the element tungsten and to some extent, on combinations of low-melting point metals such as tantalum and molybdenum are again required to permit the use of highly energetic propellants and efficient nozzle design. Without these materials a significant loss in performance up to 20 or 30 percent may be introduced. Again, the development of the refractory metals for these purposes will be of great importance for other devices but these particular solid-propellant systems cannot operate as efficiently as desired without the availability of refractory materials..."

* Future Government Programs in the field of special property materials are now in the advanced planning stage. Plans are said to be underway in the Department of Defense to accelerate high-temperature programs for refractory metals. In addition, a special survey has been made for the President's Science Advisory Committee and is now undergoing active consideration by various Government agencies. This report covers such matters as needed organizational changes, improvement of Government incentives, assurance of adequate supplies of raw materials, dissemination of research information and strengthening of basic scientific research.

NASA Propulsion Research

Here are some new areas of propulsion and energy technology being planned by the National Aeronautics and Space Administration, as outlined by Harold B. Finger of the NASA Launch Vehicle Program Office.

Solid propellant studies include ways and means of reducing the empty weight of the rocket which is made up of such items as the pressure shell and jet nozzle. The finding that solid propellant space rockets can operate with a low internal pressure indicates that light weight structures and materials may be used in the casings. For example thin fiberglass casings may replace heavy steel.

Nuclear Heat Transfer rockets under study may use liquid hydrogen to cool a jet nozzle, after which it is passed through a nuclear reactor, heated to a high temperature and accelerated through the nozzle producing thrust. In such a system specific impulse is no longer limited by the chemical energy available within the hydrogen itself. If small, light-weight reactors can be built to provide superior heating it may be possible to obtain 1000 pounds of thrust per pound of hydrogen.

Nuclear rocket studies, in conjunction with the Atomic Energy Commission now look ahead to a follow-on "breadboard engine" to the Kiwi-A reactor tested at the AEC Nevada Test Site last Summer. The follow-on will include a "breadboard" reactor, propellant tank, liquid hydrogen turbopump, liquid hydrogen cooled jet nozzle and an automatic controls system. NASA is now funding development of the turbopump and is initiating development of the nozzle. Design studies are now underway at NASA and will be initiated in private industry to evaluate the best methods of flight testing such systems. One possibility is the use of a Saturn booster for a nuclear rocket stage.

Sunflower-I proposals are now being invited from private industry. This is the code name for a solar auxiliary power system of three kilowatt capacity. One possible configuration is a solar turboelectric power unit in which the sun's rays are collected by a mirror and focused on a boiler in which some working fluid, such as a liquid metal, is boiled. A sun-seeker, attitude control and heat storage unit complete the package. It is expected that the Sunflower-I system will be useful for supplying power to payloads in the Centaur and Saturn vehicle program.

Nuclear Reactor Power Sources are being looked upon as the best means of generating large amounts of power in relatively light weight systems for space applications. NASA is still evaluating proposals for a 30 kilowatt system designated as SNAP-8, particularly the conversion mechanism. AEC is responsible for reactor development. It is hoped that SNAP-8 will be capable of providing both auxiliary power and useful propulsive power. One difficulty in such systems is the requirement for a large radiator which will reject waste heat into the space environment. For large powers, it is believed, such radiators might have to be as large as football fields. Methods of packaging and unfolding in orbit must be developed.

(For further details write Information Office, NASA, 1520 H Street, NW, Washington 25, D.C. Ask for Statement 60-115, Propulsion Technology and Research. Single copies free.)

Research Checklist

( ) New Weld Metal: Substitute electrodes have been developed by the Navy for use in welding light gage high-yield-strength structural steel to withstand dynamic loading at low operating temperatures. Available electrodes were found to be unsatisfactory in the fabrication of a shipboard missile launching system since they contributed to a notch-sensitive fusion zone in the welds.

(Report of April, 1959 now available. 64 pages. $1.75. Write OTS. U.S. Department of Commerce for PB 151 990)

( ) Trace Oxygen in Metals: Researchers at Oak Ridge National Laboratory have developed a routine analytical method to determine the amount of trace oxygen in lithium metal. The method is based on activation by thermal neutrons and radiochemical separation and is said to have made possible the determination of concentrations as small as 20 micrograms per gram of lithium.

( ) Isotopic Power: The SNAP-3 isotopic power generator developed for the Atomic Energy Commission is said to have demonstrated its performance capabilities in environmental tests simulating rocket flight. The unit was tested under shock loads of up to 50 times the force of gravity reached in one-one-thousandth of a second as well as acceleration of up to 15 G's produced in a centrifuge. The generator is said to have shown only momentary dips in output and resumption of normal performance. SNAP-3 components subsequently underwent high-velocity impact tests on a rocket sled at Aberdeen Proving Ground, Md.

( ) Saline Water Conversion: Navy and U.S. Department of the Interior are financing an $88,000 contract with the General Electric Co., for work on the so-called "thin-film" technique for water demineralization. It is hoped that the new system will be the most compact available for shipboard installation. Equipment for the process includes a concentric, vertical tube distillation unit. A thin film of salt water is spread on the inner surface of a heat transfer tube by slowly rotating wipers. Heat is provided by steam introduced on the outside of the tube. Transfer of heat through the wall of the tube causes the salt water to evaporate, and pure water -- in the form of vapor -- leaves the chamber.

( ) Extreme Environment Resistor: Studies by P.R. Mallory and Co. for the Air Force have resulted in development of a satisfactory design for a one-watt resistor said to be capable of operating for extended periods in a nuclear radiation environment at temperatures ranging from -65 C. to 500 C. High alumina ceramics, gold resinate terminals and tin oxide were used in the device.

(Report of July, 1959 now available. 47 pages. $1.25. (Write OTS U. S. Department of Commerce, Washington 25, D.C., for PB 161 081)

Publication Checklist

( ) Artic Engineering, a 1955 Navy Manual now available for public use. Covers construction and maintenance of installations in arctic regions as well as effects of low temperatures on materials, heat transfer, techniques of snow compaction and removal and other related information of an engineering nature. 473 pages. $6. (Write OTS, U.S. Department of Commerce, Washington 25, D.C. for Arctic Engineering Manual)

( ) Space Patents, the complete transcript of testimony and exhibits on the question of property rights in inventions made under Federal space research contracts. Includes reprint of supplementary material bearing on this general subject. 981 pages. Single copies free. (Write Committee on Science and Astronautics, U.S. House of Representatives, George Washington Inn, Washington 25, D.C. for Hearing No. 47)

( ) Aeronautical Dictionary, a reference work compiled by the National Aeronautics and Space Administration listing and defining some 4,000 terms. No attempt is made to cover space technology terms unless they have aeronautical application. 199 pages. $1.75. (Write Superintendent of Documents, Government Printing Office, Washington 25, D.C. for Aeronautical Dictionary - NASA)

( ) Atomic Energy Legislation, a valuable collection of statutes and material pertaining to atomic energy legislation through the 1st session of the 86th Congress. 247 pages. Single copies free. (Write Joint Committee on Atomic Energy, F-88, The Capitol Washington 25, D.C., for AEC Legislation Report, December 1959)

( ) Atomic Technical Meetings, a new catalog of printed proceedings of 126 technical meetings, conferences and symposia dealing with varied aspects of the atomic field. The availability and price of the printed proceedings for each of the meetings is given. 29 pages. Single copies free. (Write Technical Information Service Extension, Atomic Energy Commission, P.O. Box E, Oak Ridge, Tenn., for Proceedings of Technical Meetings)

( ) Computer Services, a brief management aid written for the Government on the use of private computer applications, costs and sources of further information. 4 pages. Single copies free. (Write Service Department, Washington SCIENCE TRENDS, 1120 National Press Bldg., Washington 4, D.C. for Pub. 109)

( ) Single Frequency Filters, a report by the National Bureau of Standards on methods for the efficient design of single-frequency filters which are formed by a number of resonant circuits, all tuned to the same frequency and loosely coupled together. 10 pages. 50 cents. (Write OTS, U.S. Department of Commerce,Washington 25,D.C. for NBS Technical Note 23)

( ) HEW Patent Practices, a searching report into patent practices of various agencies of the Department of Health, Education and Welfare. Report also raises serious questions over new procedures which permit compulsory licensing, without royalties, of developments resulting from research contracts. 53 pages. Single copies free. (Write Patents Subcommittee, Committee on the Judiciary, U.S. Senate, Washington 25, D.C. for Patent Practices - HEW)

Missile Ground Support Equipment Directory

Army - The Quartermaster General

Subject	Contact
Material-handling equipment, clothing and supplies	Quartermaster Research and Engineering Command (QMR&EC) Quartermaster Research and Engineering Center Natick, Massachusetts Telephone: OLympic 3-1000 Lt. Col. Carl L. Whitney, Commanding Officer QMR&EC, Ext. 646 Major R.E. Bridges, Executive Officer, QMR&EC, Ext. 268
Aerial delivery and related equipment	Mr. Harold S. Jones, Ext. 318
Air-conditioning and refrigeration equipment--self-contained units; refrigerators, portable, mobile; warehouses, insulated; liquid chillers; consulting service	Mr. Richard J. Campbell, Ext. 355
Environmental research	Dr. Walter F. Wood, Ext. 548
Foamed plastics, paper and rubber products	Dr. George R. Thomas, Ext. 430
Human factors engineering and research	Dr. Ralph Dusek, Ext. 344
Material-handling equipment -- powered and nonpowered industrial trucks; combination tractor /fork lift/ crane for rough terrain handling; straddle trucks; side-loading lift and transport trucks; pallets; gantry cranes; allied attachments for special handling; loading ramps; pneumatic dunnage	Mr. Harry S. Wilson, Ext. 456
Personnel cooling, decontamination and oversnow equipment	Mr. Paul E. Whittington, Ext. 450
Petroleum-handling equipment--cans, drums, tanks, dispensing pumps, and allied equipment	Mr. Dwight F. Hastings, Ext. 203
Protective clothing for handlers of rocket fuels and oxidizers	Mr. Ted Bailey, Ext. 636 or 266
Tents and tent-type structures, frame-type and air-supported, and allied equipment	Mr. Conway W. Weikert, Ext. 226
Preservation, packaging and packing, materials and methods	Quartermaster Food and Container Institute 1819 West Pershing Road Chicago, Illinois Tel: LAfayette 3-5500 Mr. Albert V. Grundy, Ext. 4204 or 4205

Corps of Engineers

Subject	Contact
Engineering and Construction equipment	Engineering Research and Development Laboratories (ERDL), Fort Belvoir, Va. Telephone: SOuth 5-7700
Advanced energy sources and conversion (other than nuclear) for electric power generation--electrochemical conversion; thermoelectric and thermionic devices; solar wind-power generators	Dr. George H. Hickox, Ext. 32241
Cryogenic equipment, guided missile ground support--LOX generating plant, portable and nonportable; LOX containers; converters; pumps; generator, liquid carbon dioxide; and allied equipment	Mr. C.L. Olson, Ext. 34215 or 26292
High-pressure air compressors and associated equipment	
Fire-fighting equipment; trucks; trailers; pumper, nozzle, water, monitor type; nozzle assembly; foam-making allied equipment	Mr. James Malcolm, Ext. 23200
Portable engine generators--gasoline-engine-driven; compression-ignition-engine-driven (diesel)	Mr. Donald Looft, Ext. 24240
Portable engine generators (development)--gasoline-engine-driven; compression-ignition-engine-driven (diesel)	Mr. David Ginsbert, Ext. 34257 ERDL - EDgewater 9-5500
Air-conditioning, heating and ventilating equipment and prefabricated buildings	Mr. Raymond Bartelmes, Ext. 7147
Surveying and goedetic equipment	Mr. M.C. Shetler, Ext. 34219

Transportation Corps

Transportation equipment	U.S. Army Transportation Research Command Fort Eustis, Virginia Telephone: TRinity 7-1311 Dr. Joseph de Rende, Director of Research Ext. 7183
Army aviation research	Mr. Larry Hewin, Ext. 6148
Land mobility, including rail	Lt. Col. S.D. Williamson, Ext. 6185
Surface transport research and development	Mr. Charles D. Roach, Ext. 23175
Supply, maintenance, engineering and procurement of Transportation Corps equipment	Transportation Materiel Command St. Louis, Missouri Telephone: MAin 1-6426 Col. J.W. Koletty, Director of Engineering Ext. 569 Mr. Howard Wilson, Ext. 570